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Deploying Pheromone-Baited Traps for the Western Spruce Budworm and Other Defoliating Insects[1]

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ABSTRACT

A procedure is described in which pheromone traps are mounted on poles to be used in studies where it is not desirable to hang traps from tree limbs or in study areas where trees are widely spaced or absent. Both Pherocon II and 1/2-gallon milk carton traps can be deployed by affixing them with hangers made of #9 galvanized wire to the top of 6-ft poles made of 3/4-inch PVC pipe which are set into the ground.

KEYWORDS: *Choristoneura occidentalis* Freeman, western spruce budworm, pheromones, dispersal, flight behavior

In recent years, forest entomologists in the western United States have used various pheromone-baited traps for surveys and research with several species of defoliating insects, particularly the western spruce budworm, *Choristoneura occidentalis* Freeman (Cory and others 1982), the Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD) (Daterman 1978), and the European pine shoot moth, *Rhyacionia buoliana* (Schiff.) (Daterman 1974).

Researchers and surveyors usually hang the traps from the lower limbs of conifers with some type of plastic or wire hanger. To prevent wind from blowing traps about or into dense foliage, traps are wired close to and crosswise under tree branches, and the foliage near the ends of the trap is trimmed off (Daterman and others 1979) as shown in figure 1.

In recent years, we have been studying the effects of various silvicultural and stand management practices on the local dispersal and flight behavior of the western spruce budworm in forested areas ranging from clearcuts to undisturbed stands. Often there are no trees growing from which to hang the traps. Moreover, hanging traps from tree limbs can be disadvantageous in that moth catches will be increased by attaching traps to budworm-infested trees (Liebhold and Volney 1982). Therefore, we were forced to devise some kind of system that would allow us to deploy our pheromone-baited traps exactly where we wanted them. This paper describes the method we now use to deploy two types of pheromone-baited traps.

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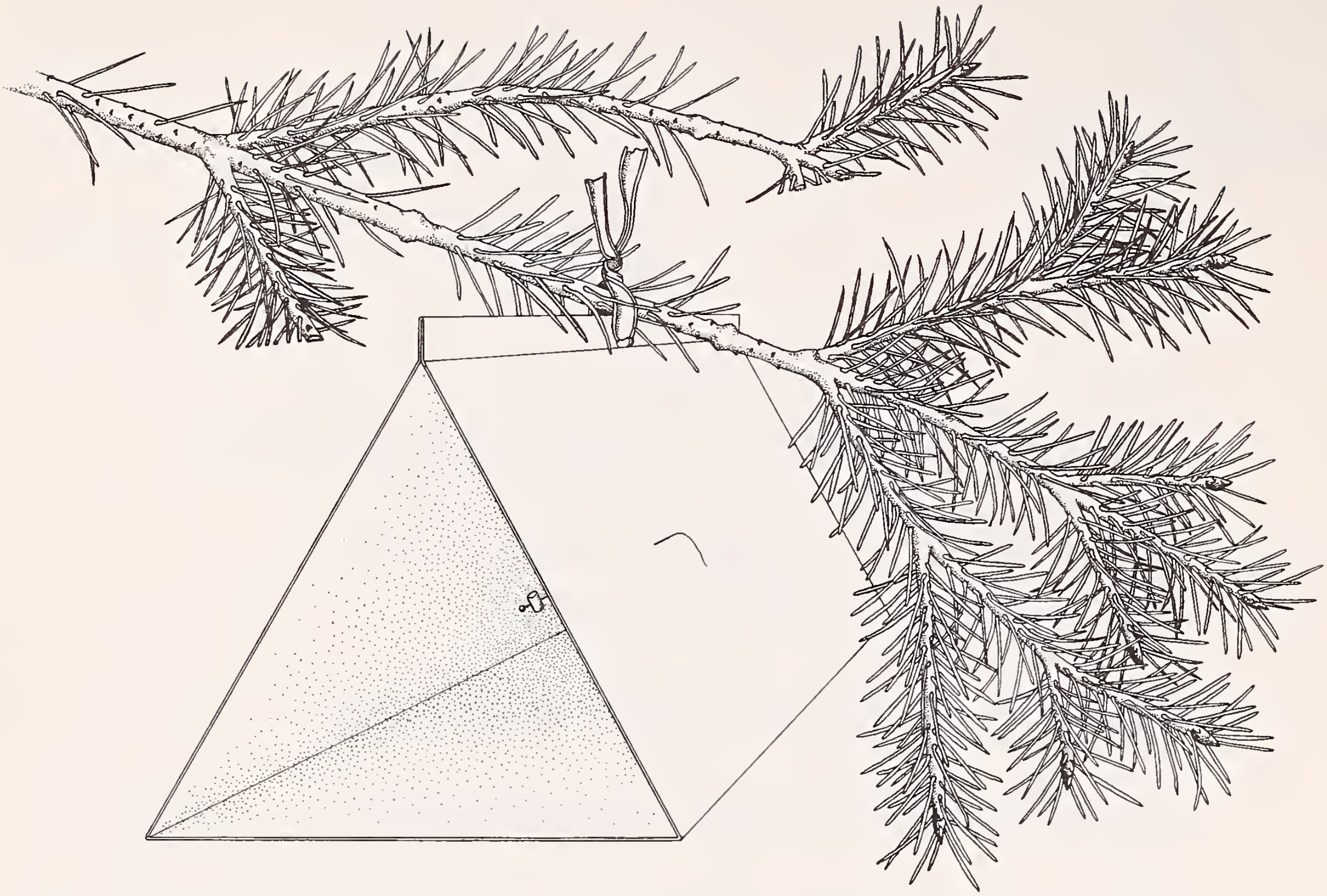

Figure 1.—Trap modified from 1/2-gallon milk carton baited with a pheromone and suspended from limb of Douglas-fir. Traps are wired crosswise and close to limb and adjacent branches trimmed off. Pin holding pheromone bait is bent over to prevent it from slipping out. This is the type of pheromone-baited trap generally used by forest entomologists in the western United States.

PREPARING TRAPS, HANGERS, AND POLES

Preparing the Traps

In 1978 we used standard, general purpose, white, fold-open Pherocon II adhesive traps[3] (formerly called Sectar I).[4] Since 1979 we have used a triangular-structured trap as described by Daterman (1978) that was modified from a 1/2-gallon (imperial measure) paper milk carton.[5] We changed to the milk carton traps in 1979 because they cost less, are simple of design, and because these types of traps are being used by other investigators West-wide. With both types of traps we coated the interior walls with a sticky material (TACK TRAP). In the case of the Pherocon II traps, the TACK TRAP was in addition to the sticky material already applied to the traps by the manufacturer. The only other modification we made on the Pherocon II trap was to punch a 1/4-inch diameter hole, 3/16 inch up from the bottom edge of the trap and centered lengthwise.

Paper milk carton stock was purchased[6] unassembled, without stickum, and unfolded, but with the fold lines scribed. The stock was cut so that when laid out flat, it consisted of three 10–1/2- × 3–3/4-inch rectangular surfaces, with a 3/4-inch margin on each end. The center surface forms the bottom, and the other two surfaces form the sides of the assembled trap. The two sides are brought together and two 1/4-inch holes are punched in the 3/4-inch margin, 1/2 inch in from each end and 1/2 inch down from the top. The trap is then laid out flat and the surfaces that will form the interior are uniformly coated with TACK TRAP. The sides are then folded closed and the 3/4-inch uncoated edges are stapled together to form the top of the trap.

Preparing the Hangers

Hangers for both types of traps are made from #9 galvanized wire. The wire is cut with an 8-inch mill bastard, rather than wirecutters, and the ends are rounded and smoothed with an electric grinder. The wires for the Pherocon II trap are cut into

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[3] Available commercially from Zoecon Corporation, Pherocon Supply Services, 925 California Avenue, Palo Alto, CA 94304.

[4] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture of any product or service to the exclusion of others that may be suitable.

[5] Available from Animal Repellants Inc., 1016 Everee Road, Griffin, GA 30223.

[6] Available either from Weyerhaeuser Company, Carton Division, P.O. Box 1826, Vancouver, WA 98663, or from International Paper Co., 401 Kindelberger Road, Kansas City, KS 66115.

11-5/8-inch pieces and those for the milk carton traps into 11-7/8-inch pieces. The hangers for each type of trap are formed by carefully bending wire segments at different angles of bend, all bends in the same plane (fig. 2). Angles of bend must closely conform to the specifications if the hangers are to firmly attach the traps to the support poles.

Preparing the Support Poles

For both types of traps, the support poles consist of heavy-duty 3/4-inch PVC plastic pipe commercially available in 20-ft lengths. From each length we cut three 6 ft 8-inch lengths, using a fine-tooth crosscut blade on a radial arm saw. (Blades with large teeth break or shatter the pipe.) Early in our studies we tried using 1/2-inch PVC pipe, but it was too flexible and provided less support than the 3/4-inch pipe. One end of each piece is cut square (at right angles to the pipe length); the other end is cut at an angle of 50 degrees to ease entry of the pipe into the ground.

In preparing poles for the Pherocon II traps, first a slot is cut in the top of the pole, 1/2 inch deep and 5/32 inch from one side of the pole, using a band saw equipped with a 1/16-inch blade. Two wooden stops are installed on the band saw platform against which the pipe is guided, to insure an accurate and uniformly cut slot.

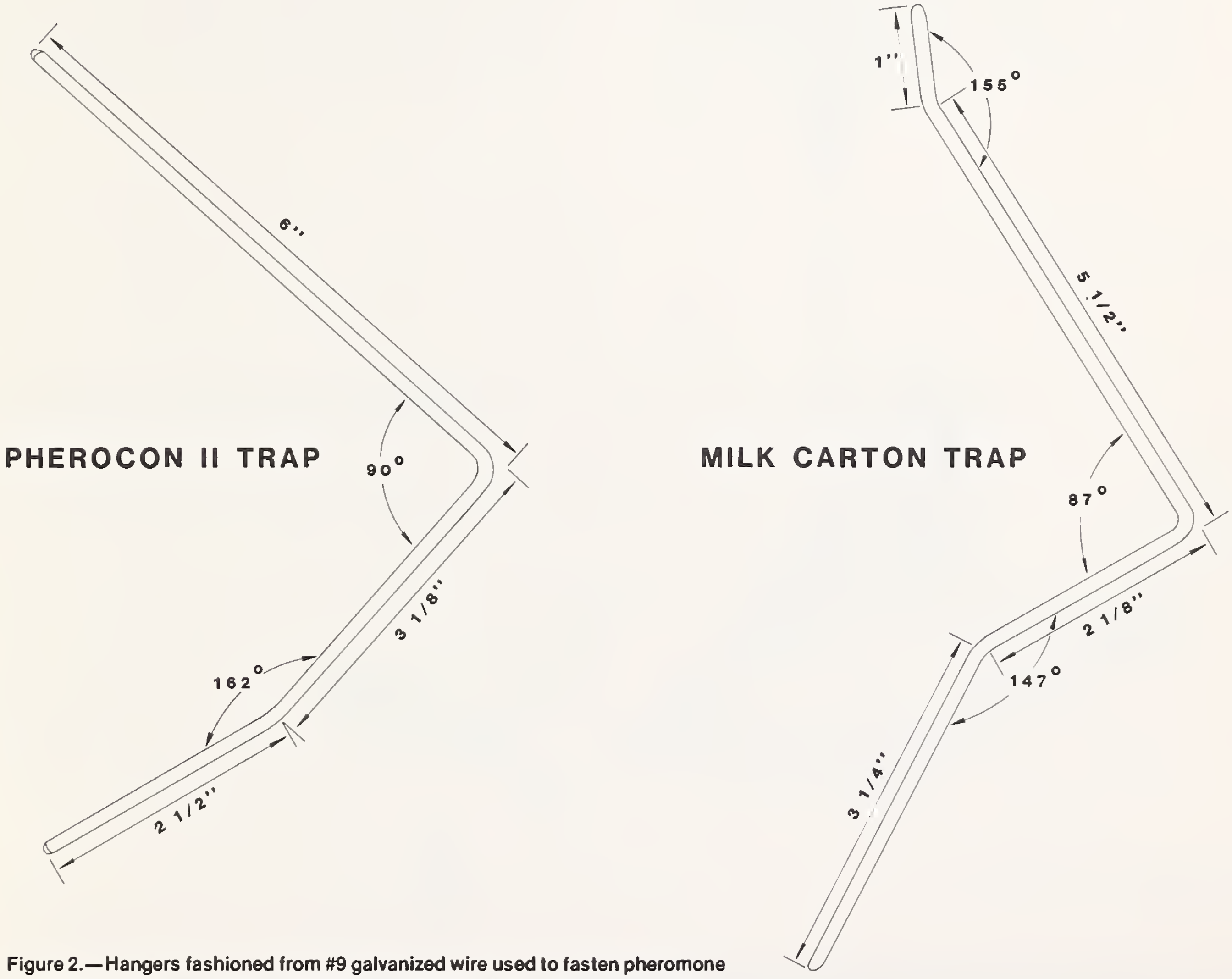

Figure 2.—Hangers fashioned from #9 galvanized wire used to fasten pheromone traps to the top of support poles, showing lengths of each wire segment and angles of bend. Hanger for Pherocon II traps (left); hanger for 1/2-gallon paper milk carton trap (right). Two hangers are used for each 1/2 gallon trap.

After the slot is cut, two holes are drilled in the top of the pole, the first hole centered between the two slots. The location of the holes drilled is critical to insure a secure attachment of the traps. Therefore all holes are drilled using a drill press equipped with a 5/32-inch bit (the same diameter as the wire hangers) and a supporting jig (fig. 3) to hold the poles while drilling. The jig is bolted to the drill press platform so that when the poles are cradled in the mortised surface and abutted against the metal stop, the pole is very precisely positioned beneath the drill bit. The drill press is lowered slowly; otherwise the bit, even though sharp, has a tendency to slide around on the smooth surface of the PVC pipe before penetrating, which results in mispositioned and irregularly shaped holes. Once the slot has been cut and the holes drilled, the preparation of the pole for the Pherocon II trap is complete.

The procedure for preparing the poles for the 1/2-gallon milk carton traps is very similar to that for the Pherocon II trap poles except that no slot is cut in the pole and, using the same jig, four holes are drilled instead of two. Once the first two holes have been drilled, the pole is rotated 180 degrees, a straight piece of hanger wire is inserted through the holes and slightly into the 2 × 4 to hold the pole steady. The second set of holes is then drilled from the opposite side of the pole as the first two. Once the four holes have been drilled, the preparation of the pole for the milk carton traps is complete.

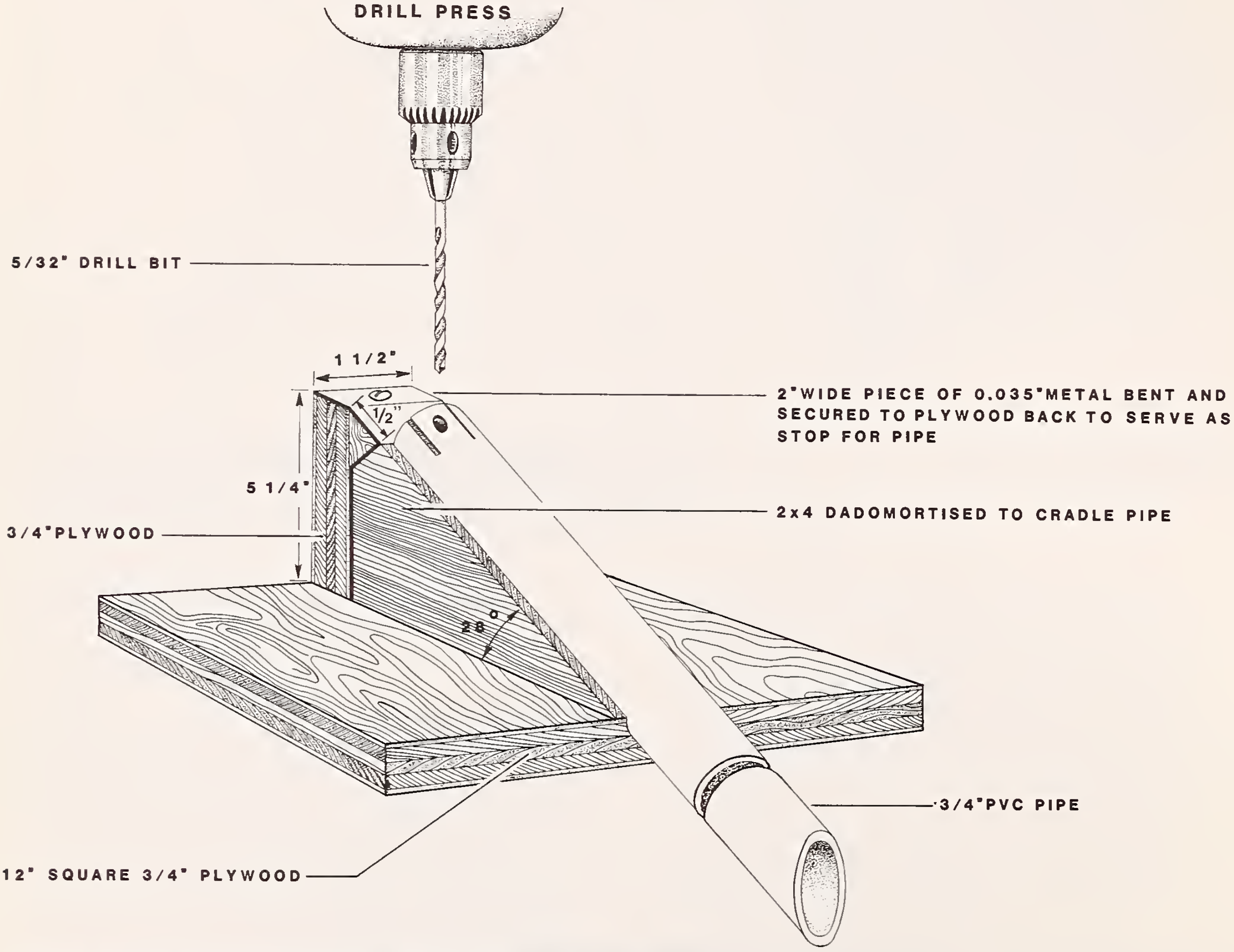
DRILL PRESS
5/32" DRILL BIT
1 1/2"
1/2"
2" WIDE PIECE OF 0.035" METAL BENT AND SECURED TO PLYWOOD BACK TO SERVE AS STOP FOR PIPE
5 1/4"
3/4" PLYWOOD
2x4 DADOMORTISED TO CRADLE PIPE
28°
3/4" PVC PIPE
12" SQUARE 3/4" PLYWOOD

Figure 3.—Jig and drill press setup for drilling hanger holes in top of pipe. Jig is precisely positioned and bolted to base of drill press so as the bit is lowered it enters upper surface of pipe exactly 3/16 inch from uppermost edge and exits lower surface of pipe 3/4 inch from uppermost edge. Pole lying in cradle has been drilled and is prepared for attachment of Pherocon II trap.

TRAP DEPLOYMENT

At the forest sampling site a digging bar with a diameter slightly larger than the PVC pipe-poles is used to punch a hole into the forest soil, 1 ft to 1-1/2 ft deep. The pole is thrust firmly into the hole and twisted into the ground, then the soil tamped with the dull end of the bar. Poles will shatter if driven into the ground with a driving maul. When poles are in place, their tops are usually 5 ft to 5-3/4 ft above the forest floor. Traps are labeled with the appropriate plot location, date, etc., with an indelible felt marker, then affixed with the wire hangers to the top of the pole.

To attach the Pherocon II trap, the bottom of the trap is centered and pulled down into the slot until the bottom of the trap is flush with the bottom of the slot and the hole punched in the trap bottom is centered over the hole drilled in the pole. Holding the 6-inch length of hanger upright, the shorter hanger arm is thrust through the holes in the pipe and the hole in the trap until the 18-degree bend abuts the pipe. The trap is then extended upward and the end of the 6-inch hanger arm slipped through the hole in the top of the trap. The trap is then slid back on the 6-inch length until the trap contacts the 90-degree bend in the hanger, allowing at least 1-1/2 inches of the wire protruding beyond the hole in the top of the trap (fig. 4). Finally, the insect pin, on which the pheromone has been impaled, is thrust through the center of one side of the trap using a pair of long-nosed pliers.

To attach the 1/2-gallon milk carton trap, the 3-1/4-inch segments of each of the two wire hangers are inserted, respectively, through the upper two holes down into the lower set of holes until the 147-degree bend of each wire abuts against the pole. At this point each 2-1/8-inch segment is horizontal and the 5-1/2-inch segment is vertical and, affixed to the pole, resembles a football field goalpost. The trap is then set on top of the pole, and the vertical wires turned, respectively, until they lay against either side of the trap. Each 1-inch wire segment is then slipped from opposite sides into the hole at either end of the top of the trap (fig. 5). Once the trap is affixed to the top of the pole, the pheromone-bearing insect pin (Daterman 1974) is thrust from the inside through one side of the trap. It is a little more difficult than with the Pherocon II trap to center the pin since the milk carton trap is considerably longer.

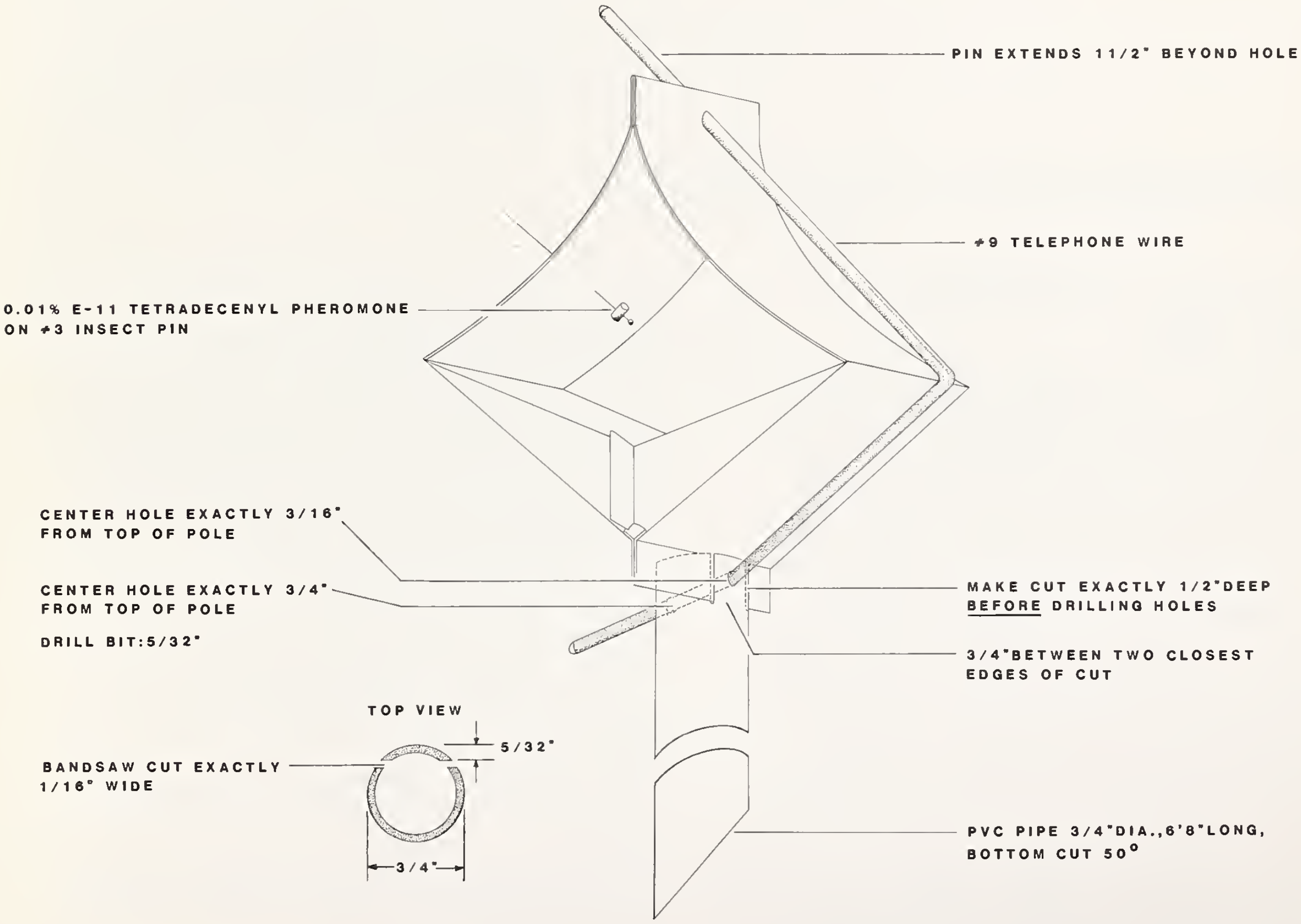
PIN EXTENDS 1 1/2" BEYOND HOLE
#9 TELEPHONE WIRE
0.01% E-11 TETRADECENYL PHEROMONE ON #3 INSECT PIN
CENTER HOLE EXACTLY 3/16" FROM TOP OF POLE
CENTER HOLE EXACTLY 3/4" FROM TOP OF POLE
DRILL BIT:5/32"
MAKE CUT EXACTLY 1/2" DEEP BEFORE DRILLING HOLES
3/4" BETWEEN TWO CLOSEST EDGES OF CUT
TOP VIEW
5/32"
BANDSAW CUT EXACTLY 1/16" WIDE
3/4"
PVC PIPE 3/4" DIA., 6'8" LONG, BOTTOM CUT 50°

Figure 4.—Pheromone-baited Pherocon II trap mounted to the top of a 3/4-inch PVC plastic pole with a single wire hanger. Top view of pole (left) shows slot cut in pole into which bottom of trap is inserted.

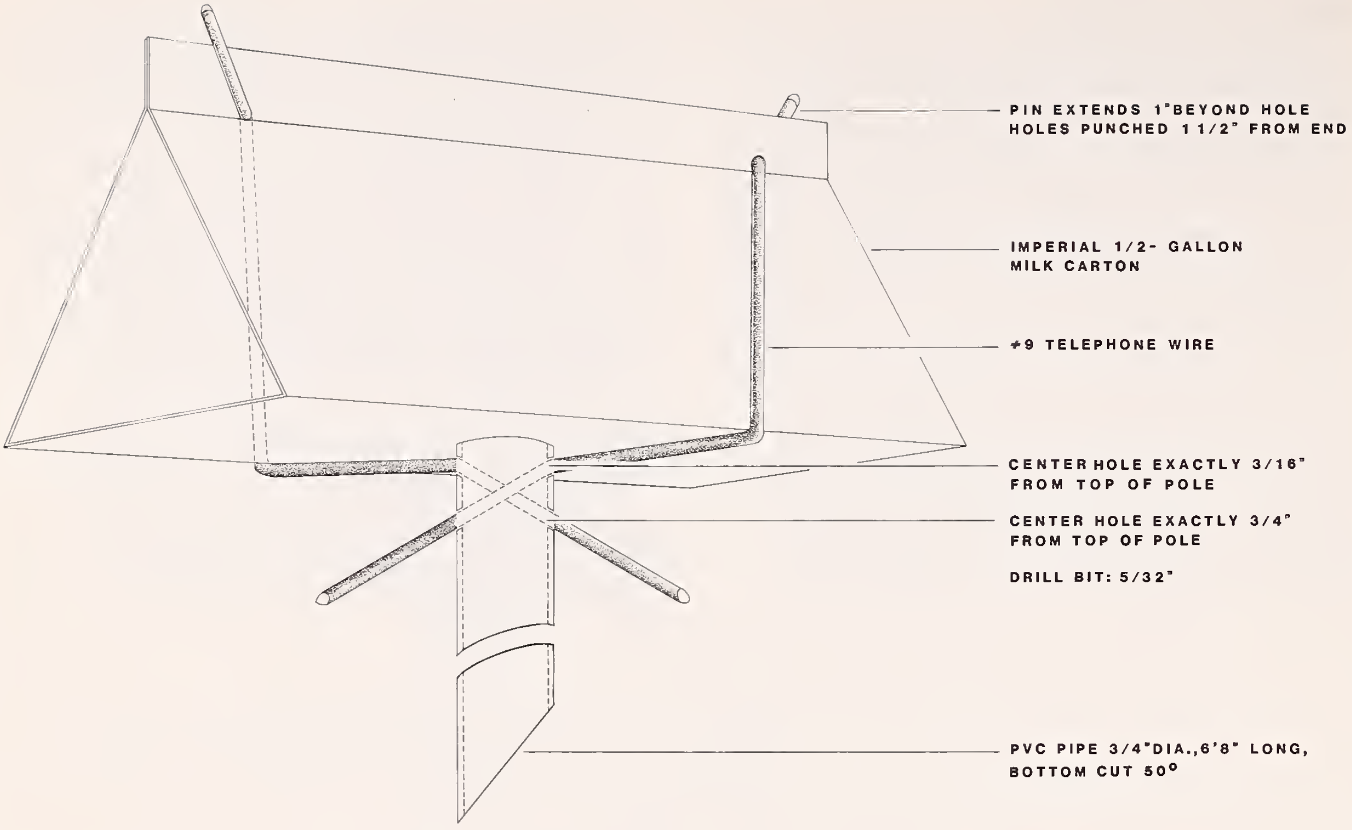
PIN EXTENDS 1"BEYOND HOLE
HOLES PUNCHED 1 1/2" FROM END
IMPERIAL 1/2- GALLON MILK CARTON
#9 TELEPHONE WIRE
CENTER HOLE EXACTLY 3/16" FROM TOP OF POLE
CENTER HOLE EXACTLY 3/4" FROM TOP OF POLE
DRILL BIT: 5/32"
PVC PIPE 3/4"DIA.,6'8" LONG, BOTTOM CUT 50°

Figure 5.—Pheromone-baited milk carton trap mounted to the top of plastic pole with two wire hangers.

DISTRIBUTION OF TRAPS IN STUDY AREAS

The distribution of traps in any study area will depend on the objectives and needs of individual investigators. For our research during the summers of 1978 and 1979, we deployed a total of 746 traps of both types in 11 different study areas; in 1978, 298 Pherocon II traps were deployed, and in 1979, 445 1/2-gallon milk carton traps were set out. We deployed traps at all study areas so that traps were placed no closer than 100 ft to one another; each trap represented at least 0.33 acre.

This sampling intensity was based on preliminary sampling in an 11-acre clearcut where we had established 32 sampling points on roughly 100 ft-centers, and in consultation with Dr. Gary Daterman (USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Corvallis, Oreg.). We concluded that a 0.01 percent concentration of the *C. occidentalis* pheromone (Cory and others 1982) would have no effect on the pheromone in adjacent traps with traps placed no closer than 100 ft to any neighbor.

EVALUATION OF DEPLOYMENT SYSTEM

The system described here has worked very well for us for several years. We usually leave the poles in the ground through fall, winter, and spring; even on steep terrain in areas of heavy snow we experience little damage. Moreover, our care in drilling the poles allows us to also leave the wires on the poles without loss during the winter.

Deer, elk, and bear have damaged some of the traps, but this would happen regardless of what type of trap or trap fixtures used. Animals occasionally rip the traps off the poles, but usually the hangers remain in place (though often bent out of shape) and there is never any damage to the poles. We experience no animal-caused damage during that period of the year when the traps are not attached to the poles.

In summary, this trap deployment system has been advantageous for us for at least four reasons:

1. The deployment method allows a systematic and gridded distribution of traps throughout our study areas.
2. The method allows reproducibility of sampling since on successive days or successive years traps are deployed at exactly the same place.
3. Since the traps are firmly affixed to the poles, and do not move about in the wind, we are able to measure directional catches.
4. We are able to control the height of the traps. This could be important for trapping some species of insects in regeneration plots, plantations, or nurseries.

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